Fractionation of phosphate by selectrodialysis

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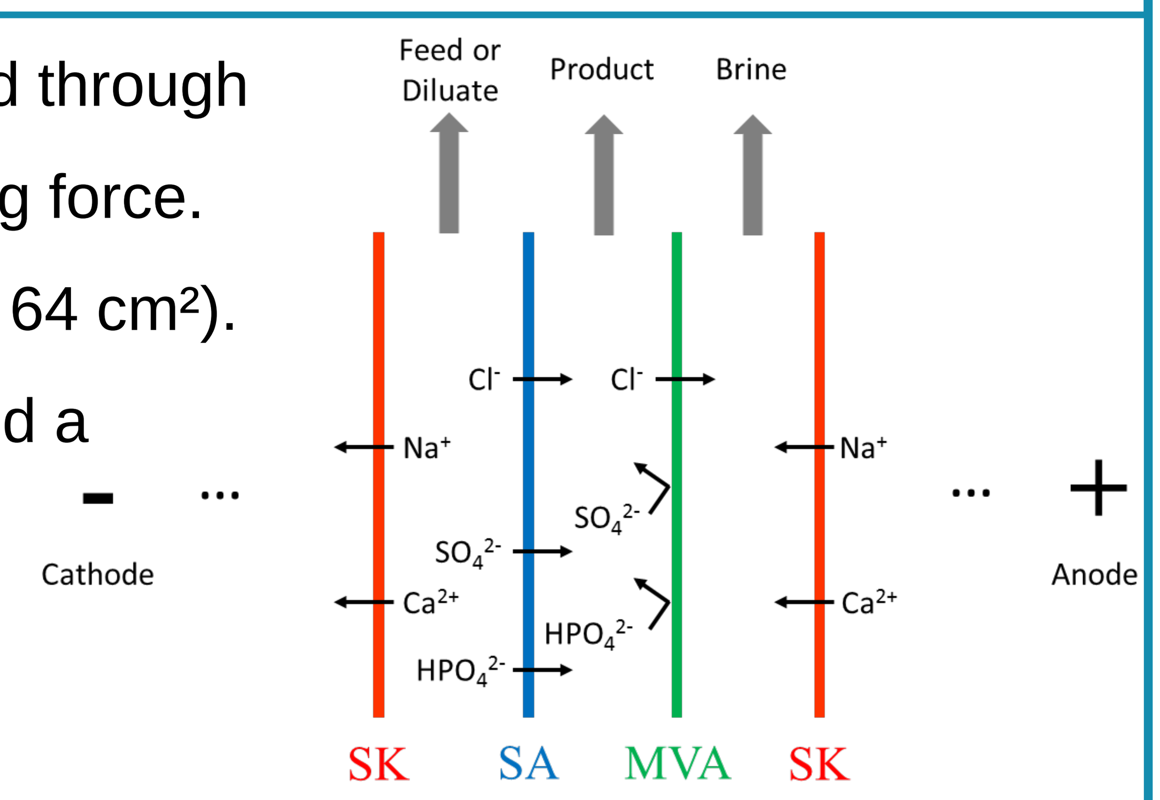
INTRODUCTION & OBJECTIVE

- Selectrodialysis (SED) is developed to fractionate and concentrate bivalent ions in a product stream.
- In the TETRA project “P Recovery 2.0”, anionSED is used to treat wastewaters with rather low PO_4^{3-}-P concentration.
- One of the cases is the treatment of an anaerobic effluent from D’Arta, a vegetable processing plant.
- The main goal of this study is to fractionate and concentrate PO_4^{3-} from this stream to a level of at least 60 $mg.L^{-1}$ PO_4^{3-}-P after which efficient recovery (either as struvite or calcium phosphate) is possible.
- Firstly, batch experiments are carried out on lab scale in order to investigate the technical feasibility of the process.
- Secondly, further upscaling towards pilot scale will be investigated on site.

MATERIAL & METHODS

- SED is an electrochemical membrane separation process in which ions are transferred through ion-exchange membranes from one solution to another using an electric field as driving force.
- Lab scale batch experiments are carried out with an ED64-004 stack (surface area of 64 cm²).
- Membrane stack consists of 5 triplets and each triplet contains a diluate, a product and a brine compartment.
- Membrane combination used: PC-SK / PC-SA / PC-MVA.
- Constant voltage of 10 V is applied.



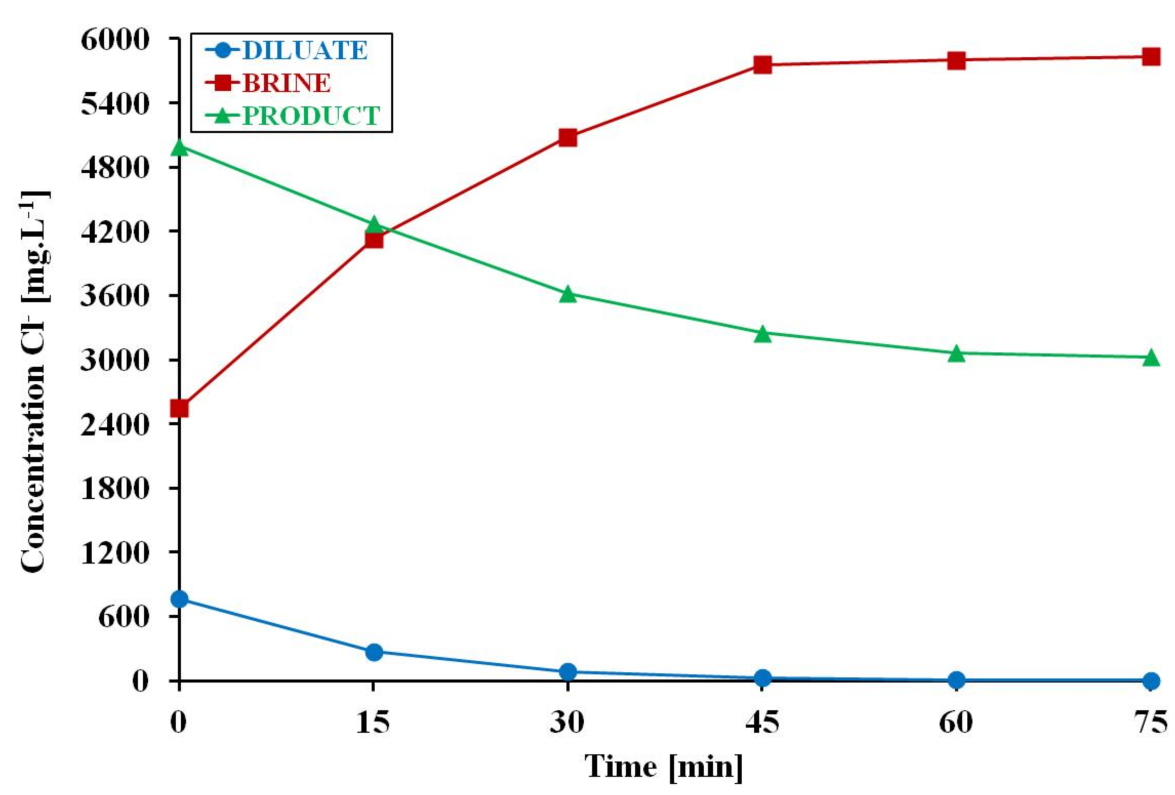
RESULTS & CONCLUSIONS

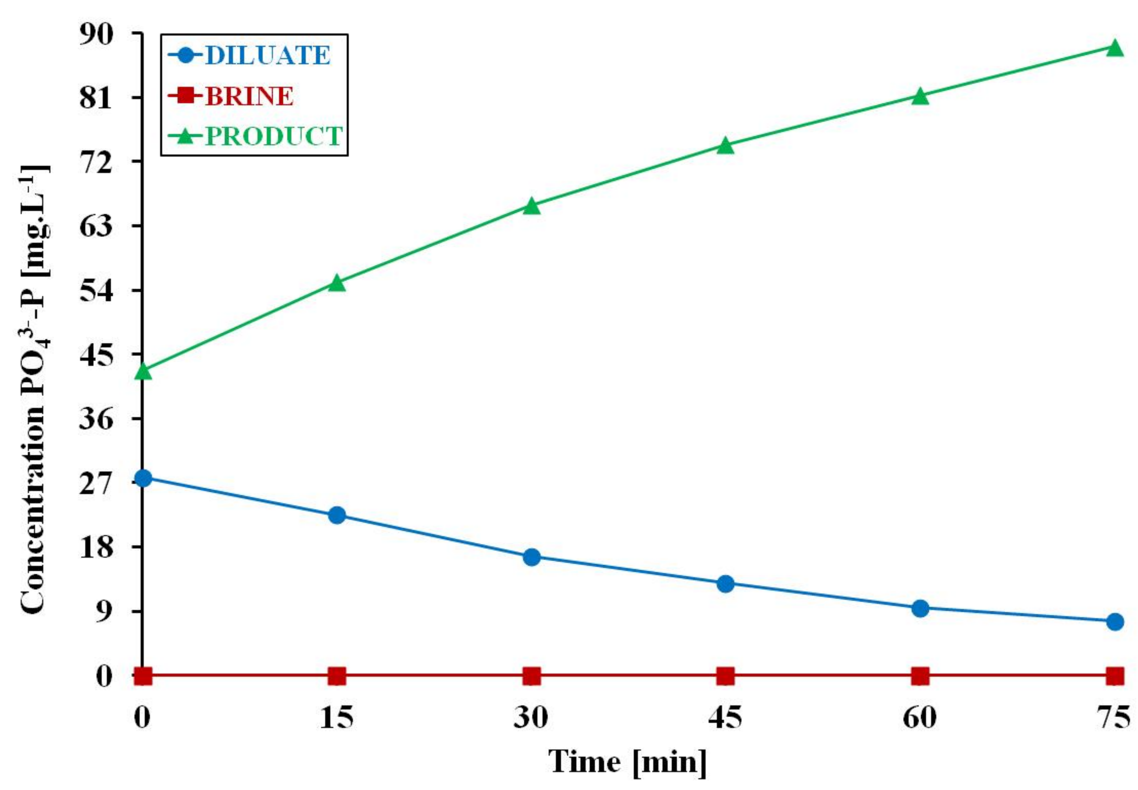
- The composition of the anaerobic effluent is quite complex, which makes selective fractionation a definite challenge. The P content amounts to 28 $mg.L^{-1}$ PO_4^{3-}-P, which is thus too low for efficient recovery.

pH [-]	Cl^- [$mg.L^{-1}$]	SO_4^{2-} [$mg.L^{-1}$]	PO_4^{3-}-P [$mg.L^{-1}$]	Na^+ [$mg.L^{-1}$]	NH_4^+ [$mg.L^{-1}$]	K^+ [$mg.L^{-1}$]	Ca^{2+} [$mg.L^{-1}$]	Mg^{2+} [$mg.L^{-1}$]	TOC [$mg.L^{-1}$ C]	TIC [$mg.L^{-1}$ C]
8	770	41	28	400	200	780	75	50	36	375

TOC and TIC stand for Total Organic Carbon and Total Inorganic Carbon, respectively.

- PO_4^{3-} desalination and fractionation is feasible against a strong concentration gradient without prior modification of the pH:





- PO_4^{3-} removed from the diluate is perfectly retained in the product and its final PO_4^{3-}-P concentration is 88 $mg.L^{-1}$.
- During the short-term batch experiments, there are no indications for scaling and/or (bio)fouling.

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